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To: Mr. John Alaksa
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ELECTROMAGNETIC INTERFERENCE (EMI) INVESTIGATION - EAR FALLS GS TO MANITOU FALLS GS RADIO SYSTEM

D.R. Goldthorpe

Tests were conducted in order to locate the EMI sources affecting the Ear Falls to Manitou Falls GS radio link. Measurements were also performed to compare the noise levels at the existing location of the transmitting and receiving antenna tower to the noise at a proposed new location approximately 73 metres west of the station. Test results are summarized.

INTRODUCTION

The System Studies Section, Communication Unit received a request from Mr. J. Alaksa, Communication Supervisor, Northwestern Region to investigate an interference problem on the Ear Falls GS to Manitou Falls GS radio system. A previous EMI survey had been completed in October 1985/1/. The latest tests were carried out over the period from May 26 to June 5, 1987.

INSTRUMENTATION

The Appendix lists the instrumentation used in the investigation.

TEST SUMMARY

1. Measurements were taken at the Ear Falls GS site and surrounding area and included noise frequency spectra, computer printouts and graphs of the noise data and oscilloscope pictures. Portable interference locators were used to identify sources.

2. The measurements indicated the presence of multiple, high level gap type noise sources. The highest amplitude levels were concentrated close to the Ear Falls GS.

3. Major noise sources were located inside Ear Falls GS on the wood pole 115 kV line circuit E2R. The loop support insulator strings on the first three poles were identified as the sources. The insulator strings were hanging with no tension on them.

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4. A line outage was scheduled to work on these three poles inside the station grounds. Due to storms in the area the outage was cancelled. However, the line crew removed the problem insulator strings working live line the next day.

5. Noise levels were reduced significantly at this location after the work had been completed. However several other gap sources still existed in the area.

6. The line crew tightened the hardware on several suspect noisy wood poles both on the distribution and high voltage lines close to the station. This should reduce a number of the minor noise sources which contributed to the ambient noise level around the Ear Falls station.

7. The 115 kV wood pole structures surrounding the small DS across the road from the Ear Falls station were also generating some gap type noise sources. The loose hardware was tightened by the line crew. However, the loop insulator support strings, the main noise contributions, could not be changed at this time.

8. Major noise sources were located on the first three steel angle transmission towers heading west from Ear Falls. The insulator loop support strings are suspected as the noise sources.

9. Noise measurements were taken at a possible new location for the radio antenna tower site, approximately 73 metres from the west fence to Ear Falls GS. These measurements were compared to the noise levels measured at the existing tower site. The noise amplitude levels at the proposed tower location ranged from 10 to 15 dB lower at a frequency of 150 MHz when the gap sources were present.

10. Most of the EMI surveys were performed around Ear Falls GS where the radio interference problem was the most severe. The Manitou GS site was surveyed briefly. Fewer interference sources existed at the Manitou site. However, some high level gap sources were present. These can be attributed to the insulator loop support strings on the angle transmission towers close to the station.

CONCLUSIONS

Degradation to the radio communication system appears to be caused primarily by the insulator strings for loop supports on several structures. These include:

1) the first three steel angle transmission towers outside the gate to Ear Falls GS heading west on line circuits E4D, M3E.

2) the insulator loop supports on line circuit E2R inside the station fence that were removed.

3) the loop supports on the 115 kV wood pole lines around the small DS across the road from Ear Falls GS.

4) the first steel angle tower outside Manitou GS.

RECOMMENDATIONS

Specifications[1] for polymer insulators have been drafted by the Transmission Line Design Department of Design and Development Division - Transmission as a possible alternative to the existing loop support insulator strings on 115 kV and 230 kV lines. The new polymer insulators can be used as a solution to the interference caused by the loop support insulator strings. The polymer insulators are a solid one piece insulator which will eliminate any possible arcing between insulators in a string caused by lack of tension or improper installation (ie omission of anti-interference cotter pins). They are also bullet proof which will reduce the possibility of interference caused by damaged insulator strings.

The Transmission Line Design Department also suggests that under certain circumstances where the loop support string is causing an interference problem, a possible solution is to eliminate the loop support altogether provided the angle of the line and stiffness of the loop permit.

The maintenance work suggested in the previous report (No 85-329) should be completed on the main structure, station side of line disconnect E2R. Replace the three insulator strings and remove the lead weights and binding wire from the one string.

The noise measurements suggest that the possible new location for the antenna tower site is a better location than the existing antenna tower site. This proposed location has a higher elevation level, a clearer line of sight, and lower ambient noise levels. Most of the existing and potential interference sources would be behind the directional antenna. Therefore, the pickup of any noise sources would be minimized.

If the new location is chosen the minimum remedial work required would be to remove the loop support strings on the first three steel transmission angle towers outside Ear Falls GS. These should be changed to the new polymeric type insulator strings or be removed completely.

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1. See line procurement specification number - LPS-X45-51380-2001-87 for 230 kV and Ontario Hydro Draft No 4 Standard specification M-689-87 File No 178.2-761-25 for 115 kV.

REFERENCES

1. D.R. Goldthorpe, "Interference Study - Ear Falls GS", Research Report No 85-329-K, November 27, 1985.

APPENDIX

INSTRUMENTATION

The following instrumentation was used during the investigation.

EMI Mobile Test Facility (truck mounted equipment for calibrated noise measurements)

1. Ailtech NM37/57A EMI-Field Intensity Meter for calibrated noise measurements.
2. Oscilloscope connected to linear video output of NM37/57A for observation of noise pulses.
3. HP X-Y Recorder for recording noise spectra (30-200 MHz).
4. Philips chart recorder for monitoring the noise levels at the Y output of NM37/57A.
5. Biconical antenna (30-200 MHz) and extendible truck mounted mast (up to 10 m).
6. Sony TV for visual inspection of interference sources.
7. TVI Analyzer (designed by Research Division) for measuring Average Crossing Rate (ACR) and Amplitude Probability Distribution (APD) - characteristics of the noise.
8. HP 9826 computer and Thinkjet printer for programmed printouts and graphs of noise measurements.

Portable (hand held instruments) for Locating EMI Sources)

1. HP model 4914 Ultrasonic Detector and parabolic reflector.
2. Micro Tech Model 1000 Power Line RFI Gun. (470-890 MHz).
3. Little Snoop (Broad Band Detector).

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